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PTO
JC971 U.S. PTO
10/050802
01/15/02

Appn. Number:_____

Appn. Filed:_____

Applicant(s): _Johs, He, Liphardt, Goeller, Woollam & Welch_

Appn. Title:_Multi-AOI-System For Easy Changing Angles-of-Incidence_

Examiner/GAU:_____ /324

Mailed: _With Application_

At:_____

Information Disclosure Statement

Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.

Following are comments on these references pursuant to Rule 98:

A Search of Patents relevant to the present invention has identified:

Patent No. 5,872,630 describes simultaneous evaluation of sample characterizing parameters such as PSI and DELTA, as well system characterizing parameters.

Patent No. 6,034,777 to describes accounting for phase shifts entered between orthogonal components of a beam of electromagnetic radiation, by present invention system multiangle prisms and/or lenses.

Patent to Dill, No. 4,053,232 describes a Rotating-Compensator Ellipsometer System, which operates utilizes monochromatic light.

Patent Nos. 5,596,406 and 4,668,086, to Rosencwaig et al. and Redner, respectively, identified systems which utilize Polychromatic light in investigation of material systems.

Patent No. 5,757,494 to Green et al. teaches a method for extending the range of Rotating Analyzer/Polarizer ellipsometer systems to allow measurement of DELTA'S near zero (0.0) and one-hundred-eighty (180) degrees. Said Patent describes the presence of a window-like variable bi-refringent components which is added to a Rotating Analyzer/Polarizer ellipsometer system, and the application thereof during data acquisition, to enable the identified capability. This _ also discusses ellipsometric ALPHA and BETA parameters.

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Patent to Thompson et al. No. 5,706,212 teaches a mathematical regression based double Fourier series ellipsometer calibration procedure for application, primarily, in calibrating ellipsometers system utilized in infrared wavelength range. Bi-refringent window-like compensators are described as present in the system thereof, and discussion of correlation of retardations entered by sequentially adjacent elements which do not rotate with respect to one another during data acquisition is described therein.

Patent to Woollam et al, No. 5,582,646 is disclosed as it describes obtaining ellipsometic data through windows in a vacuum chamber, utilizing other than a Brewster Angle of Incidence.

Patent to Johs et al. No. 5,666,201 is disclosed for general information as it pertains to Rotating Analyzer ellipsometer systems.

Patents continued from the 359 Woollam et al. Patent are:

> Nos. 5,504,582 to Johs et al.; and
> 5,521,706 to Green et al.

Said 582 Johs et al. and 706 Green et al. Patents describe use of polychromatic light in a Rotating Analyzer Ellipsometer System.

Patent to Bernoux et al., No. 5,329,357 is identified as it describes the use of optical fibers as input and output means in an ellipsometer system.

Patent to Finarov, No. 5,764,365 is disclosed as it describes a system for moving an ellipsometer beam over a large two-dimensional area on the surface of a sample system, which system utilizes beam deflectors.

Patent to Berger et al., No. 5,343,293 describes an Ellipsometer which comprises prisms to direct an electromagnetic beam onto a sample system.

Patent to Canino, No. 4,672,196 describes a system which allows rotating a sample system to control the angle of incidence of a beam of electromagnetic radiation thereonto. Multiple detectors are present to receive the resulting reflected beams.

Patent to Bjork et al., No. 4,647,207 describes an ellipsometer system in which reflecting elements are moved into the path of a beam of electromagnetic radiation.

Patent No. 6,081,334 to Grimbergen et al. describes a system for detecting semiconductor end point etching including a means for

scanning a beam across the surface of a substrate.

Patent to Ray, No. 5,410,409 describes a system for scanning a laser beam across a sample surface.

Patent No. 3,874,797 to Kasai describes means for directing a beam of electromagnetic radiation onto the surface of a sample using totally internally reflecting prisms.

Patent No. 5,412,473 to Rosencwaig et al., describes a ellipsometer system which simultaneously provides an electromagnetic beam at a sample surface at numerous angles of incidence thereto.

Patent to Chen et al., No. 5,581,350 is identified as it describes the application of regression in calibration of ellipsometer systems.

Other Patents identified are:

> No. 5,229,833 to Stewart;
> No. 5,706,087 to Thompson; and
> No. 5,963,327 to He.

SCIENTIFIC ARTICLES

An article by Johs, titled "Regression Calibration Method For Rotating Element Ellipsometers", which appeared in Thin Film Solids, Vol. 234 in 1993 is also identified as it predates the Chen et al. Patent and describes an essentially similar approach to ellipsometer calibration.

A paper by Nijs & Silfhout, titled "Systematic and Random Errors in Rotating-Analyzer Ellipsometry", J. Opt. Soc. Am. A., Vol. 5, No. 6, (June 1988), describes a first order mathematical correction factor approach to accounting for window effects in Rotating Analyzer ellipsometers.

An article by Jellison Jr. titled "Data Analysis for Spectroscopic Ellipsometry", Thin Film Solids, 234, (1993) is identified as it describes a method for determining the accuracy with which certain data points can be measured, which information allows adding a weighting factor to a curve fitting regression procedure as applied to a multiplicity of data points, said weighting factor serving to emphasize the effect of more accurate and precise data.

Other papers of interest in the area by Azzam & Bashara;

"Unified Analysis of Ellipsometry Errors Due to Imperfect Components Cell-Window Birefringence, and Incorrect Azimuth Angles", J. of the Opt. Soc. Am., Vol 61, No. 5, (May 1971);

and

"Analysis of Systematic Errors in Rotating-Analyzer Ellipsometers", J. of the Opt. Soc. Am., Vol. 64, No. 11, (Nov. 1974).

A paper by Straaher et al., titled "The Influence of Cell Window Imperfections on the Calibration and Measured Data of Two Types of Rotating Analyzer Ellipsometers", Surface Sci., North Holland, 96, (1980), describes a graphical method for determining a plane of incidence in the presence of windows with small retardation.
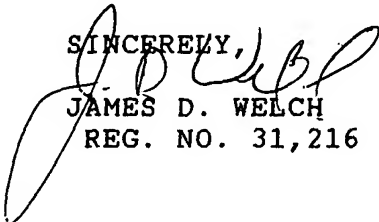
An article by Collins titled "Automated Rotating Element Ellipsometers: Calibration, Operation, and Real-Time Applications", Rev. Sci. Instrum. 61(8), August 1990 is identified as it provides insight into rotating element ellipsometers.

An article by Kleim et al. titled "Systematic Errors in Rotating-Compensator Ellipsometry" published in J. Opt. Soc. Am./Vol. 11, No. 9, Sept 1994 is identified as it describes calibration of rotating compensator ellipsometers.

A book by Azzam and Bashara titled "Ellipsometry and Polarized light" North-Holland, 1977 is disclosed and incorporated herein by reference for general theory, but is not included.

Further identified for authority regarding regression is a book titled Numerical Recipes in "C", 1988, Cambridge University Press, but is not included.

SINCERELY,

JAMES D. WELCH
REG. NO. 31,216

form PTO-1449 (REV. 7-84)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO.		SERIAL NO.

LIST OF PRIOR ART CITED BY APPLICANT
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APPLICANT	Johs eTal
FILING DATE	GROUP

dc971 U.S. PTO
10/050802
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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5872630	2/1999	Johs eTal.	356	369	
	AB	6034777	3/2000	Johs eTal.	358	369	
	AC	4053232	10/1977	Dill eTal.	356	118	
	AD	5596406	1/1997	Rosencwaig eTal	356	327	
	AE	4668086	3/1987	Redner	358	367	
	AF	5757494	5/1998	Green eTal	356	369	
	AG	5706212	1/1998	Thompson eTal	364	525	
	AH	5582646	12/1996	Woollam eTal.	118	708	
	AI	5666201	9/1997	Johs eTal	356	369	
	AJ	5521706	5/1996	Green eTal	356	369	
	AK	5504582	4/1996	Johs eTal	356	369	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
	AL							
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

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LIST OF PRIOR ART CITED BY APPLICANT (Use several sheets if necessary)	**APPLICANT** Johs et al
	FILING DATE **GROUP**

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5329357	7/1994	Bernoux et al	356	369	
	AB	5764365	6/1998	Finarov	356	381	
	AC	5343293	8/1994	Berger et al	356	369	
	AD	4672196	6/1987	Canino	250	225	
	AE	4647207	3/1987	Bjork et al	357	369	
	AF	6081334	6/2000	Grimberger et al	356	357	
	AG	5410409	4/1995	Ray	356	369	
	AH	3874797	4/1975	Kasai	356	118	
	AI	5581350	12/1996	Chen et al	356	364	
	AJ	5229833	7/1993	Stewart	356	364	
	AK	5706087	1/1998	Thompson et al	356	364	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

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EXAMINER	DATE CONSIDERED

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LIST OF PRIOR ART CITED BY APPLICANT
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APPLICANT	John et al
FILING DATE	GROUP

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5 9 6 3 3 2 7	10/1999	He et al	356	369	
	AB						
	AC						
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FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
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	AM							

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PLEASE USE THIS AS PTO FORM 1449 FOR SCIENTIFIC ARTICLES

An article by Johs, titled "Regression Calibration Method For Rotating Element Ellipsometers", which appeared in Thin Film Solids, Vol. 234 in 1993.

A paper by Nijs & Silfhout, titled "Systematic and Random Errors in Rotating-Analyzer Ellipsometry", J. Opt. Soc. Am. A., Vol. 5, No. 6, (June 1988).

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and

"Analysis of Systematic Errors in Rotating-Analyzer Ellipsometers", J. of the Opt. Soc. Am., Vol. 64, No. 11, (Nov. 1974).

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